PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER

ELGAR CORPORATION

PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER

INSTRUCTION MANUAL

PRECISION POWER
PRECISION POWER

MODEL 121
POWER SOURCE

PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER
PRECISION POWER

MODEL 121
POWER SOURCE

14-002-91/12-74/200

©Elgar Corporation

Printed in USA

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_09140

WARRANTY

Elgar Corporation warrants each instrument it manufactures to be free from defects in material and workmanship. The corporation's obligation under this warranty is limited to servicing the instrument and replacing defective parts. This warranty is effective for one year after delivery of the instrument to the original purchaser. Defects caused by improper operating conditions, misuse, negligence, or the alteration or removal of the nameplate, will void the warranty. Elgar Corporation shall in no circumstance be liable for any direct or consequential loss or damage of any nature resulting from the malfunction of the instrument. This warranty is effective in lieu of any or all other obligations or liabilities on the part of Elgar Corporation, its agents, or representatives.

DO NOT RETURN THE UNIT FOR REPAIR WITHOUT AUTHORIZATION FROM ELGAR CORPORATION. Unauthorized returns found to be within specifications will result in a $50.00 inspection fee, plus two-way freight charges.

ELGAR CORPORATION . . . THE BEST SOURCE OF POWER
8225 Mercury Court, San Diego, California 92111
Phone 714-565-1155, TELEX 69-5059 TWX 910-335-1246

TABLE OF CONTENTS

Paragraph		Page
	SECTION I GENERAL DESCRIPTION	
1-1	Scope of Manual	1-1
1-2	Introduction	1-1
1-3	General Description	1-1
	SECTION II SPECIFICATIONS	
	Specifications	2-1
	SECTION III OPERATION	
3-1	Inspection	3-1
3-2	Installation and Operation	3-1
	SECTION IV THEORY OF OPERATION	
4-1	Circuit Description	4-1
4-2	Power Supplies	4-2
4-3	Interconnections for Multiphase Operation	4-2
	SECTION V MAINTENANCE AND ADJUSTMENT	
5-1	Service Information	5-1
5-2	Factory Repair	5-1
5-3	Test Points	5-1
5-4	Output Regulation Adjustment	5-1
5-5	Current Limit Adjustment	5-1
5-6	Periodic Maintenance	5-2
5-7	Troubleshooting	5-2
	SECTION VI PARTS LIST AND DIAGRAMS	
	Parts List	6-2
	Schematic Diagram	6-4/6-5

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Power Output Derating	1-2
1-2	Typical Harmonic Distortion at 120 VA	1-2
3-1	Rear Panel Terminal Strip Connections	3-2
4-1	Interconnections for Multiphase Operation	4-3
4-2	Vector Diagram	4-4
4-3	Quasi-Square Wave	4-5
5-1	Top View	5-3
6-1	Schematic Diagram	6-5

SECTION I
GENERAL DESCRIPTION

1-1. SCOPE OF MANUAL

This manual describes the Model 121 Power Source manufactured by Elgar Corporation. It provides operating, maintenance, and adjustment instructions; a circuit description, a schematic diagram; and a parts list.

1-2. INTRODUCTION

The Elgar Model 121 Power Source provides AC power at precise frequencies for testing, motor operation, and frequency conversion. The basic power amplifier consists of two DC supplies and a direct-coupled amplifier with a tapped output transformer. The output transformer provides nominal output voltages of 28, 115 VAC that are adjustable between 0-30, 0-130 VAC. Total available power is 120 volt-amperes at full rated output voltage. Power at less than full-rated output voltage is derated as illustrated in Figure 1-1. Shown in Figure 1-2 is a curve of typical harmonic distortion. Input power is 50-60 Hz. The power transformer may be wired for 230V at 50-60 Hz.

Output power frequency is established by a plug-in oscillator. Output frequency range is 45 to 10 KHz. A variety of plug-in oscillators is available, with frequency accuracies up to .0001%.

The Elgar Power Source facilitates equipment tests to meet military specification operating requirements over the frequency range of 47 to 63 Hz or 47 to 425 Hz. The basic power source output is single-phase. Multi-phase power can be obtained however, by stacking two or three power sources. all driven by the same multi-phase plug-in oscillator.

1-3. GENERAL DESCRIPTION

The Elgar Model 121 Power Source is contained in a rack mount enclosure. A meter for output voltage monitoring, indicators for 0-30 and 0-130 output voltage configuration indication, a voltage amplitude control and a power circuit breaker that applies line power to the unit are located on the front panel. Cooling air is drawn through a front-panel grill and exhausted at the rear of the enclosure.

The enclosure contains two heat-sink assemblies, which comprise a two-section power amplifier. Control circuitry is mounted on a circuit board with test points and adjustment controls available on the top side of the board. A plug-in voltage select card, selects either the 0-30 or 0-130 volt output configuration of the output transformer. Output power is available at the rear panel terminal block and across the red and white binding posts located on the front panel.

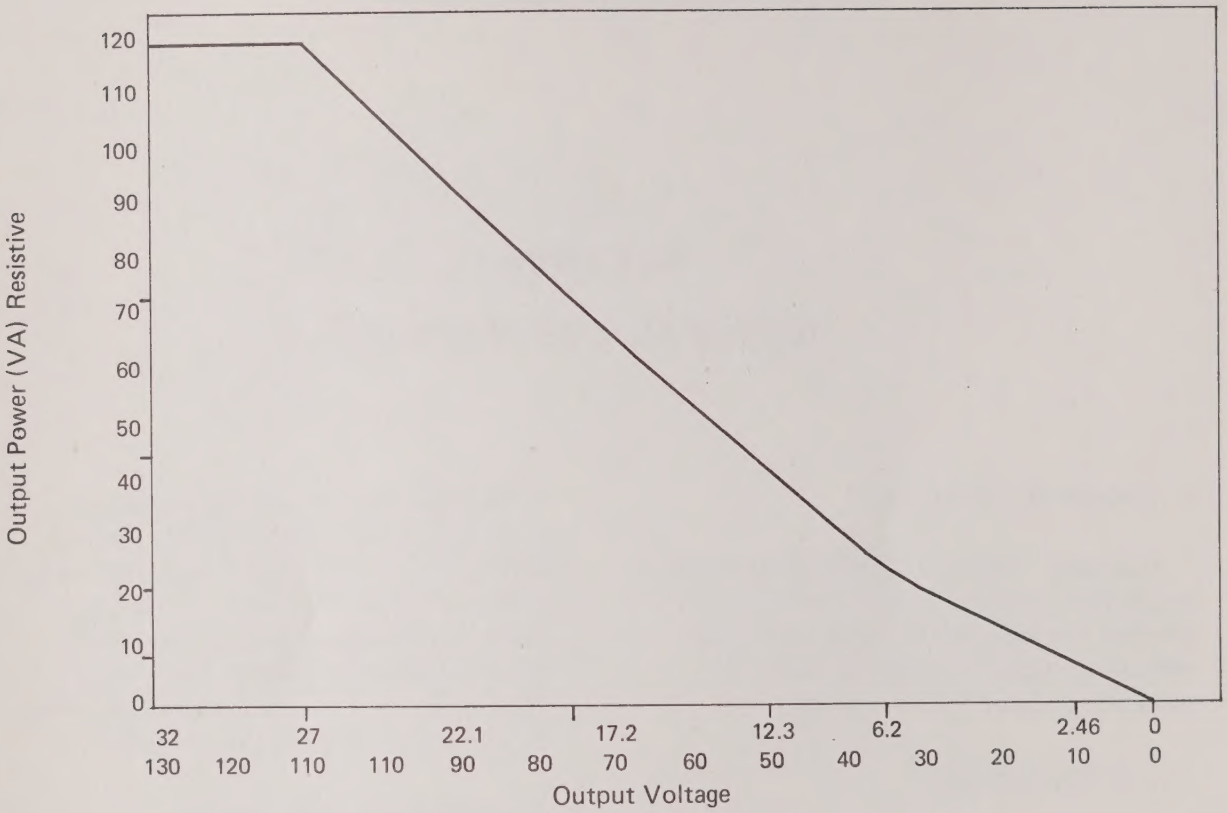


Figure 1-1. Power Output Derating

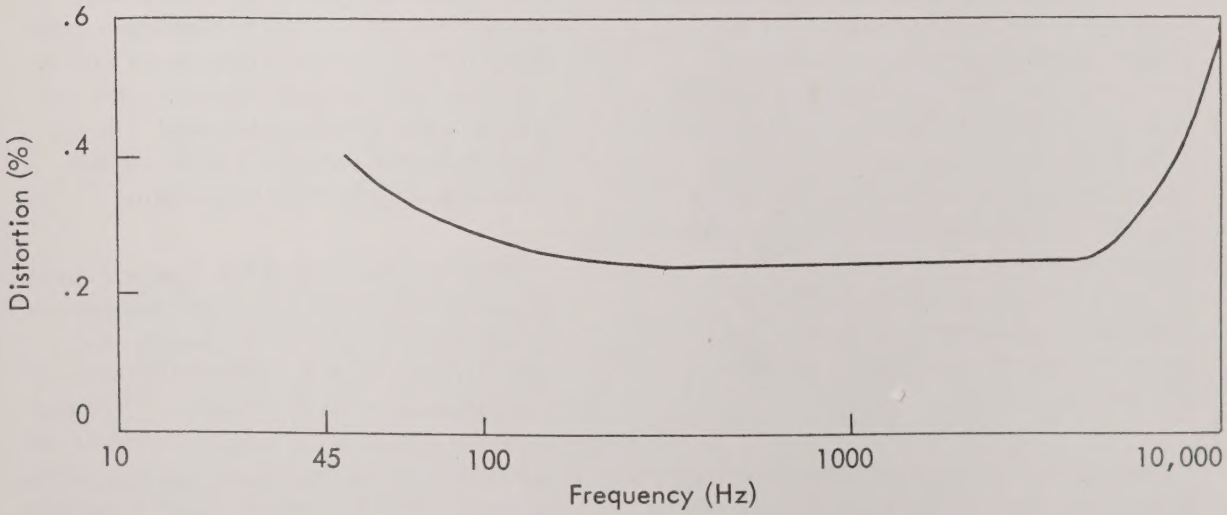


Figure 1-2. Typical Harmonic Distortion at 120 VA

SECTION II

SPECIFICATIONS

Output Power	0 - 120 VA
Power Factor	Unity to ±0.7
Output Voltage	Adjustable 0-32 VAC or 0-130 VAC (Range selected by internal card change)
Output Frequency Range	45 Hz - 10 KHz at full rated power
Distortion	Less than 0.9% (45 Hz - 10 KHz) Less than 0.5% (100 - 1000 Hz)
Output Noise	70 db below full output voltage
Load Regulation	±1%, no load to full load over full frequency range, adjustable to zero for specific load and frequency
Line Regulation	±0.25% 115 VAC ±10% ±0.25% 230 VAC ±10%
Short Circuit Protection	Output may be shorted and recovers immediately when short is removed.
Input Power	One phase 115 or 230 VAC, 45-65 Hz, 360 VA maximum
Temperature Range	0 - 50° C
Dimensions	3-1/2 x 19 inch relay rack panel by 15 inches deep overall
Weight	Approximately 45 pounds

SECTION III

OPERATION

3-1. INSPECTION

The Elgar Power Source has been aligned and tested prior to shipment. The instrument is therefore ready for immediate use upon receipt. The following checks should be made, however, to assure that the instrument has suffered no damage during shipment.

1. Inspect the shipping container before accepting it from the carrier. If damage to the container is evident, remove the instrument from the container and visually inspect for damage to the instrument parts.

2. If any damage to the instrument or container is evident, a description of the damage should be noted on the carrier's receipt, and signed by the driver or carrier agent. Save all shipping containers and filler material for inspection.

3. Forward a report of any damage to the Elgar Service Department, 8225 Mercury Court, San Diego, California 92111. Elgar will provide instructions for repair or replacement of the instrument.

3-2. INSTALLATION AND OPERATION

1. The Elgar Power Source is designed for installation in a standard electrical equipment rack. Install the power source so that the flow of cooling air into the front panel grill and out the rear panel grill is unobstructed.

2. Insert the plug-in oscillator.

3, Connect the load to the appropriate terminal of the rear panel power output terminal block (see Figure 3-1). For bench mounted applications, the front panel binding posts may be used for 28 or 115V output.

4. Connect the input power cord on the rear panel to an appropriate source of single phase power.*

5. Turn front panel power switch on. The pilot lamp that illuminates indicates the output voltage range as selected by the plug-in volts select card. If the other range is desired, remove the top cover of the unit and plug opposite end of volts select card into the connector.

6. Adjust front panel AMPLITUDE control for the desired output voltage as indicated on the front panel voltmeter.

*See main schematic for 115V or 230V input connections.

NOTE

Certain Elgar plug-in oscillators do not require the use of the front panel AMPLITUDE control. Others are remotely programmed. Consult the oscillator instruction manual.

Figure 3-1. Rear Panel Terminal Strip Connections

SECTION IV
THEORY OF OPERATION

4-1. CIRCUIT DESCRIPTION

The input signal, approximately 3 VRMS, is provided by the plug-in oscillator. For most oscillators, the input signal amplitude is controlled by front panel AMPLITUDE control, R1. The signal is applied to the first amplifier stage consisting of differential amplifier Q1 and Q2. The differential amplifier provides high DC stability. The emitter currents are supplied by R10 from a +12V supply regulated by CR1. The output of Q1 is coupled to the base Q3 which provides drive signals to the complementary driver stage, Q6 and Q7. Q7 operates as an emitter follower to drive emitter follower Q8 which provides base drive signals to the upper half of the push-pull class B power amplifier. Q6 is operated as a common emitter stage to provide phase inversion of the drive signals to the lower half of the power amplifier. The output of Q6 is applied to emitter follower Q11, which provides base drive signals to the lower half of the power amplifier.

The power amplifier consists of 4 power transistors mounted on two heat sinks. The .22 ohms emitter resistors ensure equal current sharing of the output transistors. The driver and output stages are operated from nominal ±40 VDC supplies. Thermal switch shown on heatsink No. 1 turns drive signals off to the power amplifier in the event the power amplifier overheats from excessive load or restricted airflow through the wind tunnel.

The power amplifier is also protected from overloads or short circuits on the output by current limit transistors Q4 and Q5. The current in the upper half of the power amplifier is sampled by R35 and applied to the base of Q5 through selected resistor R28. When the voltage at the base of Q5 reach Q5's conduction threshold (approximately .6V) drive signal is diverted from the base of Q7 thus preventing any further increase in output current. Simultaneously, the current in the lower half of the power amplifier is sampled by R31. This voltage is applied to the base of Q4 through selected resistor R29. When the voltage at the base of Q4 reaches Q4's conduction threshold, drive signal is diverted from the base of Q6 preventing any further increase in output current of the lower half of the power amplifier.

Amplifier output (TP2) is connected to output transformer T2, which steps up the amplifier voltage to the required output level. Negative ac feedback path is from TP2 through R16 to the base of Q1. Capacitor C7 across R16 is used to prevent high frequency oscillations in output. Load regulation is accomplished by

passing the TP2 wire from the heat-sink plugs through a current transformer T3. Positive current feedback is taken across the secondary through regulation adjustment potentiometer R7 and to the base of Q1 through R5. R6 and C4 are used as a high frequency regulation boost network.

4-2. POWER SUPPLIES

Plus and minus 40 VDC for the power amplifiers are developed by rectifier bridge from the secondary voltage of power transformer T1. C1-C2 are filter capacitors for these supplies and R2 and R3 are bleeder resistors.

4-3. INTERCONNECTIONS FOR MULTIPHASE OPERATION

Two or three Model 121 Power Sources may be used to generate two-phase or three-phase AC power. Two-phase or three-phase signals are generated in a two-phase or three-phase oscillator installed in the master power amplifier. Signals from the oscillator are carried to one or two slave power amplifiers (See Figure 4-1), each of which has a dummy oscillator plug-in which makes the required signal interconnections installed in it. The front panel AMPLITUDE control on the master amplifier controls the amplitude of all the amplifiers outputs simultaneously. The front panel AMPLITUDE controls of the slave amplifier(s) however, must initially be set so that their output voltages equal the master amplifier output voltage.

Two-phase operation requires two power sources. Three-phase operation may be accomplished with three power sources in "wye" connection, or with two power sources in open-delta connection. The use of three Model 121's for three-phase operation provides 360 VA total output, while the use of two power sources provides 240 VA total output. A more detailed circuit description of two-phase and three-phase power sources is provided in the oscillator instruction manuals.

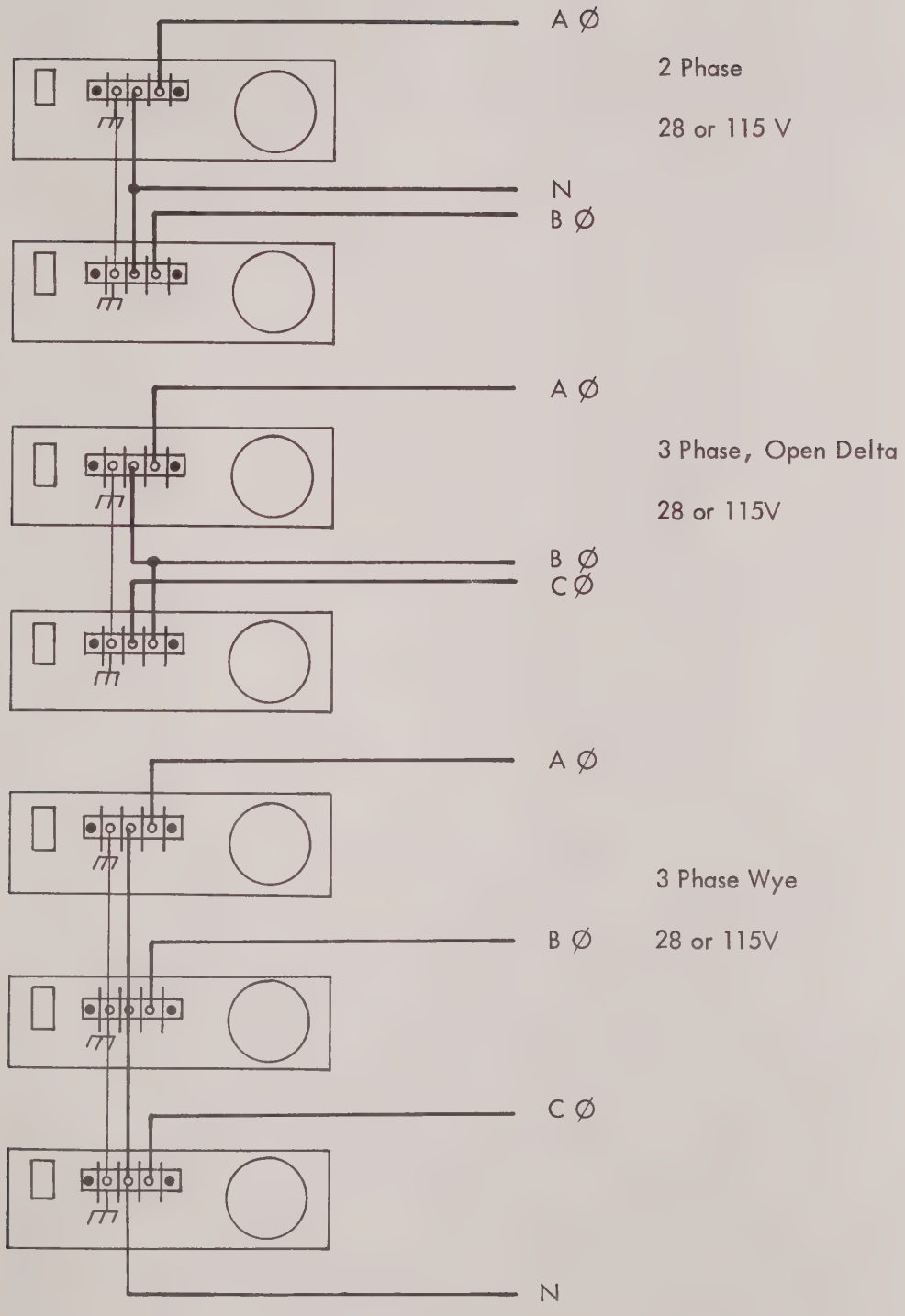


Figure 4-1. Interconnections for Multi-Phase Operation

4-3. Continued

In the open delta configuration two power amplifiers of equal VA rating are driven by a standard three phase oscillator having 120° phase angle between ØA, ØB and ØC. An open delta requires that the two amplifiers have a 60° phase angle between them and this is accomplished by inverting the second amplifier.

In these systems the amplifier containing the plug-in oscillator is referred to as the master or A phase source. The second amplifier is referred to as the slave or B phase source.

The open delta hook-up shown in Figure 4-1 page 4-3 is shown below as a vector diagram in Figure 4-2.

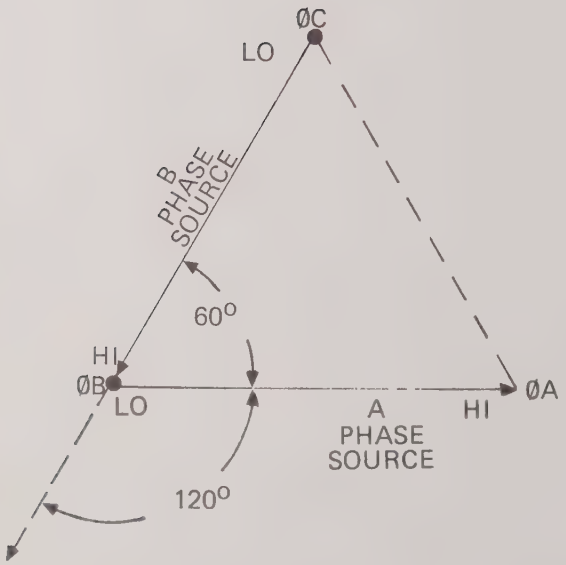


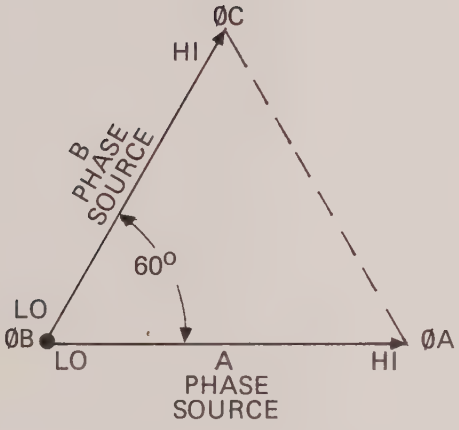
Figure 4-2

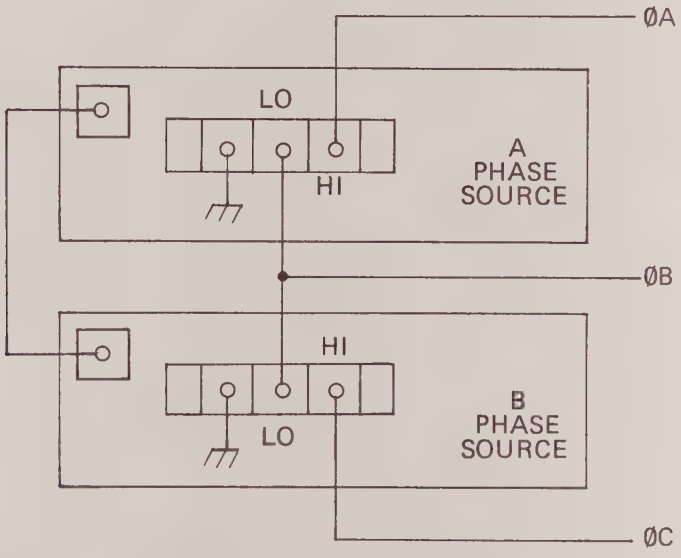
4-3. Continued

Certain specialized oscillators such as the Super-Stable (SS) series and the Quasi-Square wave series are designed only for open delta configurations using two amplifiers and have the phase angle between the ØA and ØB drive signals at 60°.

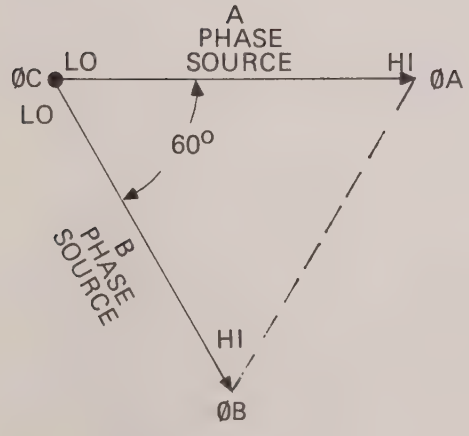
When using the SS series or quasi-square wave systems the inter-connections would be per Figure 4-3.

QUASI-SQUARE WAVE SUCH AS 443-1-111





SUPER STABLE SUCH AS 443-.01SS



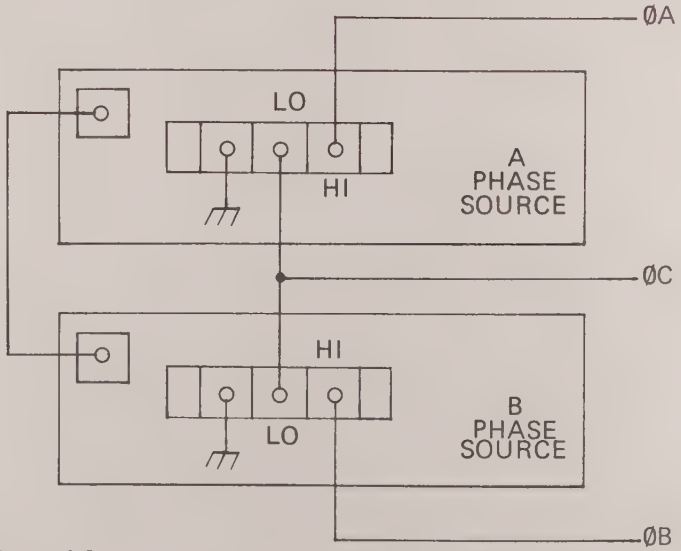


Figure 4-3

SECTION V

MAINTENANCE AND ADJUSTMENT

5-1. SERVICE INFORMATION

Questions concerning the operation, repair or servicing of this instrument should be directed to the nearest Elgar representative or to the Service Department, Elgar Corporation, 8225 Mercury Court, San Diego, California 92111. Include the model number and serial number in any correspondence concerning this instrument.

5-2. FACTORY REPAIR

Should it be necessary to return an instrument to the factory for repair, please contact the Elgar Corporation Service Department for authorization to make shipment. Do not return the unit without authorization.

5-3. TEST POINTS

Test points and adjustment controls are conveniently provided at the top of the amplifier circuit board, accessible by removing the top cover of the instrument (See Figure 5-1). The test points are as follows:

TP1 – Circuit common – Brown
TP2 – Amplifier output – Red
TP3 – Oscillator signal – Orange

5-4. OUTPUT REGULATION ADJUSTMENT

The regulation adjustment, R7, is set at the factory to give ±1% load regulation over the frequency range of the power source. The regulation may require re-adjustment if the load is highly reactive or if zero regulation is desired for a specific load and frequency. To make this adjustment, disconnect the load and read the output voltage. Connect the load and adjust R7 until the same reading is obtained.

NOTE

If the load is heavy enough to cause current limit transistors Q5 and Q4 to conduct, the output voltage will be reduced, giving an indication of poor load regulation. Load voltage fall-off due to current limiting action should not be compensated by the regulation adjustment.

5-5. CURRENT LIMIT ADJUSTMENT

Current limits are preset with selected components at the factory and therefore are not field adjustable.

5-6. PERIODIC MAINTENANCE

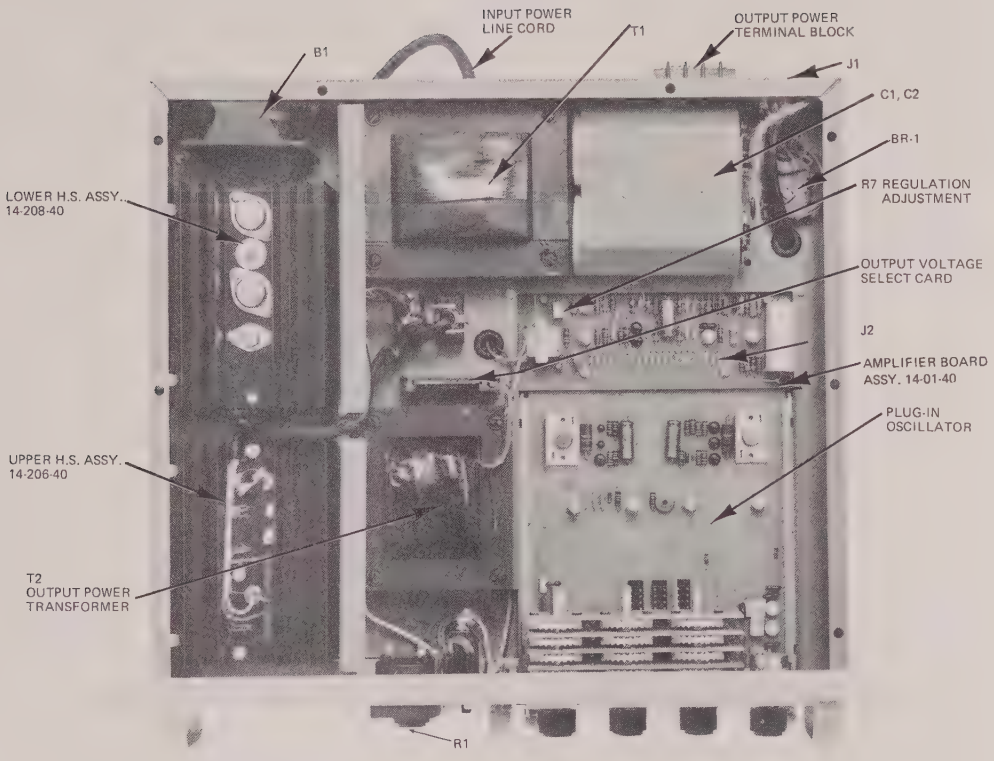
The only periodic maintenance required by the Model 121 power source is occasional cleaning of the heat sinks. The heat sinks may be inspected through the front panel air grill. If enough dust and dirt have accumulated to restrict the air flow, an air jet should be directed through the front panel grill while the instrument is operating. If this does not dislodge the dirt, the heat sink must be removed to be cleaned.

5-7. TROUBLESHOOTING

5-8. CIRCUIT BREAKER TRIPS. If the circuit breaker trips at no load, a fault in either the power transistors or power rectifiers is indicated. Unplug both heat sinks and try the circuit breaker. If it does not trip, look for a shorted power transistor, (power transistors can be tested with an ohmmeter). If the circuit breaker still trips, look for a shorted rectifier bridge. If all diodes and filter capacitors are good, a fault in the power transformer or wiring harness is indicated.

5-9. OUTPUT DISTORTION. Output distortion may be caused by overloading. Check the load current waveform with an oscilloscope since some high crest factor loads may draw considerably more peak current than is indicated by a load ammeter.

5-10. OVERHEATING. If overheating causes thermostat S1 to close, the output voltage will fall to zero. Overheating may be caused by restricted air flow or excessive environmental temperature (greater than $50^{o}C$).



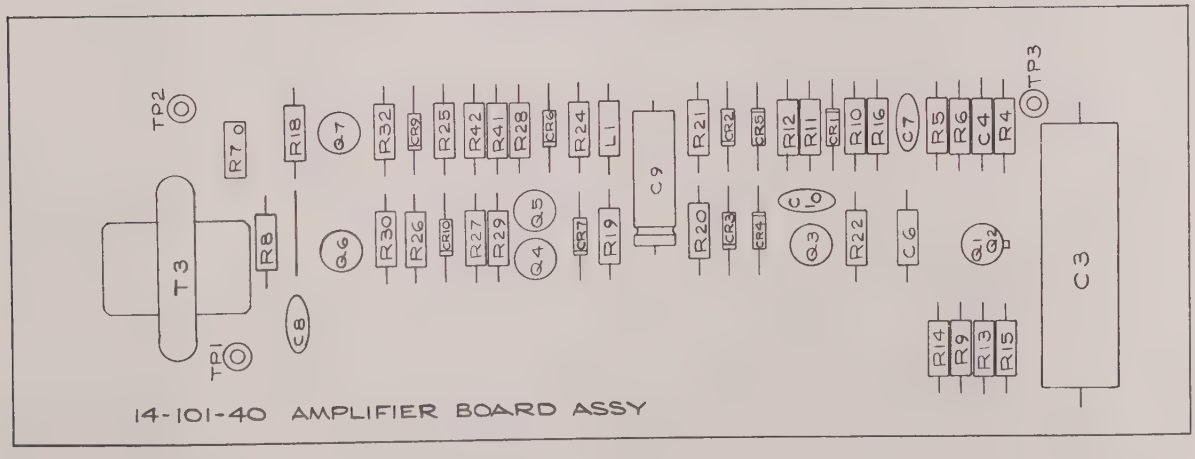


Figure 5-1. Top View

SECTION VI

PARTS LIST AND DIAGRAMS

CHASSIS PARTS LIST MODEL 121

SCHEMATIC DESIGNATION	VALUE	DESCRIPTION OR TYPE	RATING	MANUFACTURER		ELGAR PART NUMBER
				NAME	PART NUMBER	
R1	0-10K	Potentiometer		Spectrol	53410K	819-103-53
R2,R3	4.7K	Carbon	2W, 5%	Speer	RC42GF472J	804-472-05
R31	.1 ohm	Wire Wound	10W, 5%	Dale	CW10.1	808-0R1-05
R45	4.7 ohm	Carbon	½W, 5%	Speer	RC20GF472J	802-4R7-05
C1,C2	9000 uf	Alum. Elec.	50V	G.E.	86F168M	826-908-12
C13	.015 uf	Cer. Disc	1KV	Centralab	DDM202	821-153-10
BR1		Diode Bridge	25A	Motorola	MDA990-3	847-990-3X
B1		Fan		Pamotor	8500	853-850-01
T1		Pwr. Xfmr		Elgar		990-171-90
T2		Output Xfmr		Elgar		990-172-90
T3		Current Xfmr		Elgar		990-116-90
DS1,DS2		Lamp		Eldema		854-68K-22
CB1		Ckt. Brkr	6.5 Amp	Airpax	HPG1-61-0652	852-652-51
M1		Voltmeter	0-150 VAC	Ammon	AM-1-150	857-259-1T
J1		Receptacle	12 Pin	Cinch Jones	S312AB	856-312-S1
P1		Mating Conn.	12 Pin	Cinch Jones	P312CCT	856-312-P1
J3,J4		Receptacle		Cinch Jones	S308AB	856-308-S1
J5				Elgar		893-251-50
Output Voltage Select Card				Elgar		914-102-21
R43	133K	Metal Film	1/8W, 1%	Dale	RN60C1333J	813-133-2F
R44	15.8K	Metal Film	1/8W, 1%	Dale	RN60C1582J	813-158-2F

HEATSINK ASSEMBLY No. 1 and No. 2 (14206-40 & 14-208-40)

SCHEMATIC DESIGNATION	VALUE	DESCRIPTION OR TYPE	RATING	MANUFACTURER		ELGAR PART NUMBER
				NAME	PART NUMBER	
R33,R34,R37,R38	47 ohm	Carbon	½W, 5%	Speer	RC20GF470J	802-470-05
R35,R36,R39,R40	.22 ohm	Wire Wound	5W, 5%	Dale	CW5.22	807-R22-05
C11,C12	.0047 uf	Mylar	200V, 10%	Sprague	192P 472	822-472-05
CR11,CR12		Diode		Westing-house	368D	845-368-DX
Q8,Q11		Transistor		Motorola	2N4912	839-491-2X
Q9,Q10,Q12,Q13		Transistor		RCA	2N4348	841-434-8X
P3,P4		Plug		Cinch Jones	P308CCT	856-308-P1
S1*		Thermostat		Elmwood	3400	861-340-0X

*Used only on Assy. No. 14-206-40

AMPLIFIER BOARD ASSEMBLY No. 14-101-40

SCHEMATIC DESIGNATION	VALUE	DESCRIPTION OR TYPE	RATING	MANUFACTURER		ELGAR PART NUMBER
				NAME	PART NUMBER	
R4	3.32K	Metal Film	1/8W, 1%	Dale	RN60C3321F	813-332-1F
R5	4.75K	Metal Film	1/8W, 1%	Dale	RN60C4751F	813-475-1F
R6,R14,R41,R24, R42	FSV	Carbon	½W, 5%	Speer	RC20GF———J	802-XXX-05
R7	1K	Potentiometer		Helipot	78PR1K	819-102-63
R8	33	Carbon	½W, 5%	Speer	RC20GF330J	802-330-05
R9, R18-R20	4.7K	Carbon	½W, 5%	Speer	RC20GF472J	802-472-05
R10,R25	6.2K	Carbon	½W, 5%	Speer	RC20GF622J	802-622-05
R11	3.9K	Carbon	½W, 5%	Speer	RC20GF392J	802-392-05
R13,R26	1.8K	Carbon	½W, 5%	Speer	RC20GF182J	802-182-05
R15	2.2K	Carbon	½W, 5%	Speer	RC20GF222J	802-222-05
R16	33.2K	Metal Film	1/8W, 1%	Dale	RN60C3322F	813-332-2F
R21,R28,R29	68	Carbon	½W, 5%	Speer	RC20GF680J	802-680-05
R22	200	Carbon	½W, 5%	Speer	RC20GF201J	802-201-05
R27	5.6K	Carbon	½W, 5%	Speer	RC20GF562J	802-562-05
R30,R32	100	Carbon	½W, 5%	Speer	RC20GF101J	802-101-05
C3	10 uf	Mylar	10V, 5%	IMB	SA9B106J	822-106-X0
C4,C6	FSV	Paper	200V, 10%	Sprague	192P————	822-XXX-05
C7	200 pf	Dip Mica	550V, 5%	Arco	DM15201J	820-201-05
C8	220 uf	Tantalum	10V	Sprague	196B227X0010GB	823-227-61
C9	50 uf	Alum Elec	50V	Sprague	500D506G50DD7	824-506-71
C10	470 pf	Dip Mica	500V	Arco	DM15471J	820-471-05
CR1		Zener Diode	12V	Motorola	1N5242	843-524-2X
CR2-CR9		Diode		Westing-house	1N4003	845-400-3X
Q1,Q2		Diff. Amp. PNP		National	2N3810	849-381-0X
Q3,Q7		Transistor		RCA	2N3440	837-344-0X
Q4		Transistor		Fairchild	2N3638	834-363-8X
Q5		Transistor		Fairchild	2N3567	835-356-7X
Q6		Transistor		MOT	SJ5109	836-423-6X
L1	150 uh	Super Wee-ductor		Nytronics	SWD150	851-150-01

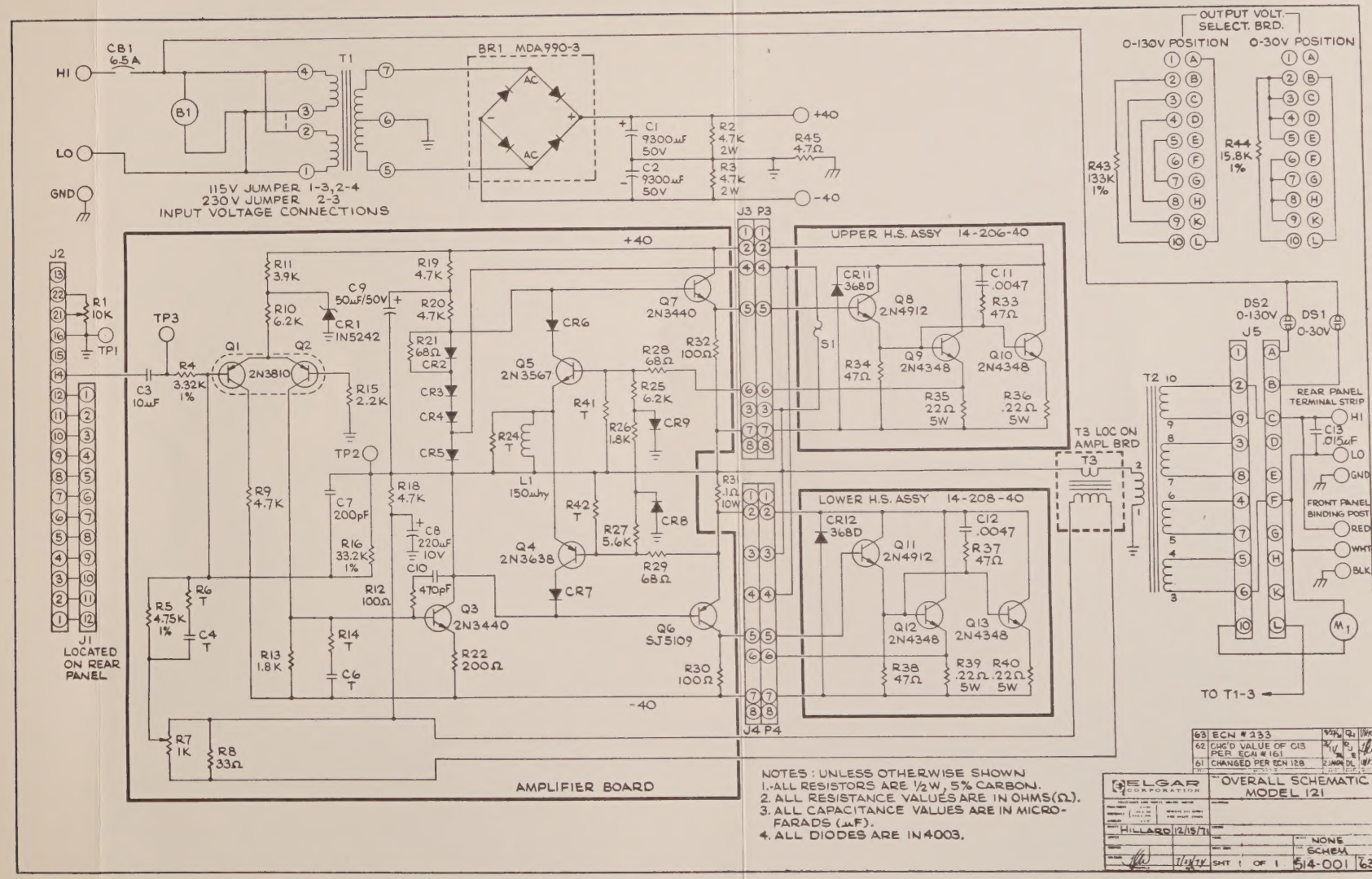


Figure 6-1. Schematic Diagram

www.manualsplus.com
1007206